REMARKS

The applicant's representatives David L. Feigenbaum and Misha K. Hill spoke with examiner Borlinghaus and his supervisor Hyung Sough on June 8 to discuss potential claim amendments. No agreements were reached.

The comments of the applicant below are each preceded by related comments of the examiner (in small, bold type).

The disclosure is objected to because of the following informalities: enclosure of appendix is improper. An appendix is limited to enclosure of a sequence listing table or a computer program listing (see MPEP § 608.05). Otherwise, information contained within the appendix should be incorporated into the specification or filed through an IDS. Appropriate correction is required.

The applicant respectfully requests that correction of the requirement for incorporation of the appendix into the specification be deferred until such time as the examiner has determined that there are patentable claims.

Claim 1 - 3 and 8 -10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 (lines 7-8) claims "computations including ... a shift in the mean of the first probability distribution to obtain a second probability distribution." However, "a shift" is not a computation, but a result of a computation.

Claims 1 (lines 10-11) and 9 (lines 19 -20) claims "making information...available within a time frame that is useful to investors." Such measurement of a time frame is indefinite in size and scope.

Claim 8 (lines 3-4) claims "the second time is sufficiently soon after the first time that any shifting of the variables that affect option prices is small." Such measurement of a time frame, either via a unit of time or unit of variable change, is indefinite in size and scope.

Claims 1, 2, 3, 8, and 9 have been amended.

Claims 1 - 3 and 9 -10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Disclosed Prior Art (applicant's specification and appendix) in view of Makridakis (Makridakis, Spyros; Wheelwright, Steven C; Hyndman, Rob J. Forecasting Methods & Applications. 3rd Edition. John Wiley & Sons. Danvers, MA. 1998. pp 13 – 16 and 82), Jackwerth (Jackwerth, Jens Carsten & Rubenstein, Mark. Recovering Probability Distributions from Option Prices. The Journal of Finance, vol. LI, no. 5. December 1996. pp. 1611-1631) and Wadsworth (Wadsworth, Harrison M. The Handbook of Statistical Methods For Engineers & Scientists. 2nd Edition. McGraw-Hill. New York, NY. pp. 6.1 - 6.3).

Regarding Claim 1, Disclosed Prior Art discloses a method comprising:

• receiving data representing current prices of options on an asset, the options being associated with different strike prices of the asset at a future time, (see specification, p. 1, lines 6-10);

• performing computations ("taking the second derivative of a continuous price curve") to derive from the data ("option prices" conveyed via a "price curve") an estimate ("probability density function") corresponding to a price or prices of the asset at a future time (expiration date), (see Appendix A, pp. 1 -2); and

• an operation ("second derivative") on a result of the data ("option prices" conveyed via a "price curve") to obtain a first probability function ("probability density function"), (see Appendix A, pp. 1 - 2).

Disclosed Prior Art does not teach underlined limitations - a machine-based method comprising:

• by machine, performing computations to derive from said data an estimate of a corresponding to a price or prices of the asset at a future time;

• the computations including a smoothing operation performed in a volatility domain, an operation on a result of the smoothing to obtain a first probability distribution, and a shift in a mean of the first probability distribution to obtain a second distribution;

• making information about the second probability distribution available within a time frame useful to investors.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have automated the method, since it has been held that broadly providing a mechanical or automatic means to replace manual activity that accomplishes the same result involves only routine skill in the art. In re Venner, 120 USPQ 192.

Utilization of smoothing functions to smooth data and/or models to account for possible noise, fluctuations and/or outliers contained within underlying data is old and well known in the art of statistical analysis and development of mathematical models, as evidenced by Makridakis (see p. 82). Furthermore, the desire to maximize smoothness in probability distributions created from option prices is also old and well known in the art of statistical analysis and development of mathematical models, as evidenced by Jackwerth (see abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Disclosed Prior Art by utilizing a smoothing operation upon the data, as disclosed by Makridakis, to account for volatility in said data, prior to further processing of said data, ensuring that possible volatility fluctuations were addressed prior to further computations, producing the much desired smooth probability distribution, as disclosed by Jackwerth, enhancing its predictive value.

Claim 1 has been amended. In the field of finance, as explained in the specification, "the volatility rate of an asset (often simply called its volatility) is a measure of uncertainty about the returns provided by the asset. The volatility rates of a stock may typically be in the range of 0.3 to 0.5 per year" (p. 13, lines 23-26). In particular, the specification notes that "Black-Scholes assumes constant interest rates and volatility" (p. 1, line 24 – p. 3, line 1). Thus, volatility is a

variable, not noise or an attribute of the shape of the data. A smoothing operation "performed on implied values of a volatility parameter" as claimed has a specific meaning in the field of finance that is not described and would not have been made obvious by Makridakis's smoothing in the time domain so that "[a] pattern can be distinguished from randomness" (Makridakis, p. 82).

The operations discussed in Makridakis are performed in the time domain to predict future events based on patterns in past events (e.g., "In many instances the pattern can be broken down (decomposed) into subpatterns that identify each component of the time series separately" (Id.)). In contrast, the data in claim 1, roughly speaking, describe the state of the market at the current time, where part of that state is related to future events ("**current prices of options** on an asset, **the options being associated with** different strike prices of the asset at **a future time**"). The predictions are based on the data for the current time, not data over some time series. One acquainted only with the general principles of statistics and time-domain modeling described in Makridakis would not be able to make such predictions from data describing a single point in time without the claimed method.

Makridakis does not describe and would not have made obvious "performing computations ... including a smoothing operation performed on the option price data as a function of the corresponding strike price, the operation performed on implied values of a volatility parameter at varying strike prices in the Black-Scholes option pricing formula." The methods described in Makridakis would not have enabled one to derive "an estimate of probabilities corresponding to a price ... at a future time" from "data representing current prices of options."

> **Development of a statistical model for forecasting purposes and the standard methodology employed for the development of said model is old and well known in the art of statistical analysis and the development of mathematical models, as evidenced by Makridakis (see pp. 13 - 16). Such methodology consists of the following steps:**
>
> **(1) collecting data;**
> **(2) matching said data to an existing model;**
> **(3) shaping and/or fitting said model to account for data, such as through shifting of parameters, as evidenced by Wadsworth (see pp. 6.1 - 6.3);**
> **(4) forecasting based upon said model;**
> **(5) evaluating model accuracy; and**
> **(6) return to step (3) for further adjustment and/or refinement of said model.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Disclosed Prior Art, Makridakis and Jackwerth by incorporating the fitting and/or shaping of said probability distribution on the basis of additional data, as disclosed by Makridakis, allowing for the continual refinement and correction of said model on the basis of new incoming data.

Wadsworth's discussion of shifting parameters "for assessing whether a statistical model is an appropriate one for the data" (p. 6.3) does not describe and would not have made obvious obtaining a second probability distribution by "adding a risk premium to the first probability distribution." More generally, Wadsworth is not applicable to the claimed method. Wadsworth describes standard engineering methods of determining *which* statistical model fits a particular set of experimental data. In contrast, in the method of claim 1, computations are performed on the data "representing current prices" to directly compute estimates of future data. The data is not simply manipulated to fit a standard statistical model from which to extrapolate estimates.

Additionally, as Disclosed Prior Art discloses "In the real world, the prices of the underlying asset changes with time, and there will be a corresponding change in option prices." (emphasis added), (see specification, p. 12, lines 6 - 8). It would have been obvious to one of ordinary skill at the time the invention was made to have modified Disclosed Prior Art, Makridakis and Jackwerth by incorporating a shifting of parameters, as disclosed by Wadsworth, such as the mean, to account for changes in incoming data, as disclosed by Disclosed Prior Art, and as a general component of the model development process.

Claim 1 does not recite receiving data that changes with time. Shifting of the option prices over time is described in claim 8, and these comments are addressed below.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Disclosed Prior Art.

Regarding Claim 8, Disclosed Prior Art discloses a method comprising:

- **receiving data representing prices of options on a given asset at a first time, the options being associated with spaced-apart strike prices of the asset at a future time, (see specification, p. 1, lines 6-10); and**

- **performing computations ("second derivative") to derive from said data an estimate of a quantized implied probability distribution ("pdf) of the price of said asset at a future time, (see Appendix A, pp. 1 - 2).**

Disclosed Prior Art does not teach underlined limitations a method comprising:

- **the data also representing prices of options at a second time, in which an underlying price of the asset at the second time is shifted from an underlying price of the asset at the first time, and the second time is**

sufficiently soon after the first time that any shifting of other variables that affect option prices is small:

• estimating, based on the prices of the options at the second time, prices of options at the first time;

• by machine, performing computations to derive from said data an estimate of a quantized implied probability distribution of the price of said asset at a future time, the quantized implied probability distribution corresponding to both the prices of options at the first time and the prices of options at the first time estimated from the observations at the second time.

Receipt of updated financial data revealing potential of changes in the underlying financial information is old and well known in the art of information technology and financial markets, as evidenced by Disclosed Prior Art (see specification, p. 12, lines 6 -8). Furthermore, receipt of updated financial data in real-time, near-real-time and/or small time intervals is old and well known in the art of information technology. It would have obvious to one of ordinary skill in the art at the time the invention was made to have modified Disclosed Prior Art by incorporating the receipt of data at multiple times at small time intervals, reporting changes in the data, allowing for the constant receipt of incoming data to be modeled by the probability distribution.

Claim 8 has been amended. Merely using updated data to refine a model does not describe and would not have made obvious the specifically claimed technique of using the data from the second time to add data points to the dataset from the first time, with the added points corresponding to "strike prices other than the spaced-apart [i.e., real] strike prices." This effectively increases the sample size *at the first time*, increasing the accuracy of the prediction in a novel way. This technique is not found in any of the cited or allegedly disclosed prior art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have automated the method, since it has been held that broadly providing a mechanical or automatic means to replace manual activity that accomplishes the same result involves only routine skill in the art. In re Venner, 120 USPQ 192.

Development of a statistical model for forecasting purposes and the standard methodology employed for the development of said model is old and well known in the art of statistical analysis and the development of mathematical models, as evidenced by Makridakis (see pp. 13 - 16). Such methodology consists of the following steps:

(1) collecting data;
(2) matching said data to an existing model;
(3) shaping and/or fitting said model to account for data;
(4) forecasting based upon said model;
(5) evaluating model accuracy; and
(6) return to step (3) for further adjustment and/or refinement of said model.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Disclosed Prior Art and Makridakis by incorporating the fitting and/or shaping of said probability distribution on the basis of additional data, as disclosed by Makridakis, allowing for the continual refinement and correction of said model on the basis of new incoming data.

As noted above, Makridakis is not applicable to the claimed method. The claims do not recite, and the specification does not describe, matching data to an existing statistical model or shaping such a model to account for the data. To the extent that any model is described, it is an analytical model, and rather than fitting data to the model, the model's analysis is directly applied to the data to generate the "implied probability distribution of the price of the asset at a future time." This process does not involve fitting any data to an existing statistical model.

Response to Arguments

Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection. Arguments concerning hindsight and obviousness, in general, contained within arguments filed on 2/2/06 will be addressed below.

In response to applicant's argument concerning impermissible hindsight, examiner asserts that "[a]ny judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill at the time claimed invention was made and does not include knowledge gleaned only from applicant's disclosure, reconstruction is proper." In re Mclaughlin, 170 USPQ 209, 212 (CCPA 1971).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

Therefore, even if the references in the instant case do not expressly suggest the specific combination claimed by the inventor, the courts have been satisfied when an examiner "presents a] convincing line of reasoning as to why artisan would have found claimed invention to have been obvious in light of references' teachings." Ex parte Clapp, 227 USPQ 972, 973 (BdPatApp&Int 1985).

Furthermore, applicant's argument in support of applicant's contention that combination of prior art methods is non-obvious based upon the fact that the examiner has "not produced any other references combining, or [explicitly] suggesting combining" said prior art methods, despite the value of such a output of said combination, is faulty as production of such prior art references is not the employed standard, (see Applicant's Arguments filed on 2/2/2006, p. 5 of 8). Applicant's contention that "[i]f the claimed methods were obvious, others would have been practicing it," is erroneous for the same reason, (see Applicant's Arguments filed on 2/2/2006, p. 5 of 8).

The applicant maintains its position that the examiner has applied impermissible hindsight to reconstruct the claims without proper motivation to do so from the references or from a line of reasoning not guided by the applicant's own disclosure. As for the examiner's failure to produce any references showing the actual methods claimed or suggesting combining the various references to produce the claimed method, these are relevant factors as secondary considerations of non-obviousness. The need or desire to predict asset prices is well-known, and the failure to produce any references showing the claimed solution to that need shows that that solution has not previously been realized.

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Regarding Claim 2, ...

Regarding Claim 3, ...
Regarding Claims 9-10, Claims 9 - 10 recite similar limitations to Claim 1 and are therefore rejected using the same art and rationale as applied in the rejection of Claim 1.

Claim 9 has been amended and is patentable for similar reasons as claims 1 and 8. All of the dependent claims are patentable for at least the reasons for which the claims on which they depend are patentable.

Canceled claims, if any, have been canceled without prejudice or disclaimer.

Any circumstance in which the applicant has (a) addressed certain comments of the examiner does not mean that the applicant concedes other comments of the examiner, (b) made arguments for the patentability of some claims does not mean that there are not other good reasons for patentability of those claims and other claims, or (c) amended or canceled a claim does not mean that the applicant concedes any of the examiner's positions with respect to that claim or other claims.

No fees are believed due at this time. Please apply any charges or credits to deposit account 06-1050, reference 11910-002001.

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Respectfully submitted,

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